Preface

All of us use pharmaceuticals for ourselves or for our pets, in husbandry, in agriculture or in aquaculture. But who knows what will happen to the compounds after their administration or use? Are they distributed in the environment or are they eliminated beforehand? What are the possible effects and risks for humans and the environment in connection with the emission of pharmaceuticals into the environment? Pharmaceuticals, diagnostic aids as well as disinfectants used in medicine enter municipal sewage and the aquatic environment. Drugs and growth promoters used in veterinary medicine and husbandry are excreted by animals and emitted into soil via manure or can be part of the runoff from soils after heavy rain fall, which then passes into surface water. Drugs used in aquaculture are passed directly into surface water. Some, such as X-ray contrast media, are excreted completely unchanged, while others are metabolised either into metabolites, which are still active or inactive metabolites. Outdated medications or their remnants are sometimes disposed of down household drains or as (household) waste. The fate, occurrence and effects of pharmaceuticals in the aquatic and terrestrial environment is still mainly unknown.

The disposal of pharmaceuticals in the environment means that a huge number of different substances in different amounts, products and modes of action have to be considered. Therefore, it is difficult to obtain an appropriate overview on the ongoing research. It is even more difficult to identify the most important questions for a systematic approach. The information available is still scarce and not sufficient for sound assessment and decision-making. For this reason, the European Science Foundation (ESF), located in Strasbourg (France), commissioned the workshop "Pharmaceuticals in the Environment." It was held in July 1999 in Freiburg (Germany). The core of the book consists of issues discussed and explored in depth during this workshop. Some other authors, not present at the workshop, have been added.

The book does not claim to give a complete review of the state of the art related to pharmaceuticals in the environment. There is a lot of literature, symposia, international networking and research organising on EDSs. This is still lacking for pharmaceuticals other than hormones. This book gives a short review of the fate, occurence and effects of pharmaceuticals using examples of some typical compounds to highlight the most important questions and issues related to pharmaceuticals into the environment. Input, occurence, fate and effects as well as the possible risks and their assessment are addressed. The book also gives an introduction to this new field of environmental chemistry, ecotoxicology and environmental hygiene.

This book would not have been realised without the workshop "Pharmaceuticals in the Environment" commissioned by the European Science Foundation (ESF). Dr. A. Moth-

Wiklund and her team from the Life and Environment Standing Commitee (LESC) at the ESF always gave good support whenever necessary. All the participants of the workshop contributed to the lively discussions and the identification of the important questions of research in the future. The contributors to this volume were very patient with the editor. The workshop and the book would have not been realised without the support of the director of the Institute of Environmental Medicine and Hospital Epidemiology at the Freiburg University Hospital, Prof. Dr. med. Franz Daschner, and of all my co-workers in the field of pharmaceuticals in the environment. Tina Kümpel and Birgit Stadel helped with the manuscripts. Dr. Witschel from Springer Verlag (Heidelberg) created the opportunity to publish this book. Special thanks to my wife and my children for their encouragement and their support.

Thank you!

Klaus Kümmerer
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